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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/598,958	09/15/2006	Hidetoshi Ito	112857-607	2591
29175	7590	05/14/2009	EXAMINER	
K&L Gates LLP			HOBBS, LISA JOE	
P. O. BOX 1135			ART UNIT	
CHICAGO, IL 60690			PAPER NUMBER	
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/598,958	<b>Applicant(s)</b> ITO ET AL.	
	<b>Examiner</b> Lisa J. Hobbs	<b>Art Unit</b> 1657	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on 17 February 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 11-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |                                                                                      |                                                                   |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____                                                          | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 17 February 2009 has been entered.

### ***Claim Status***

Claims 11-23 are active in the case; claims 21-23 were added with the RCE. Claims 1-10 have been cancelled by preliminary amendment. Claims 11-23 are under examination; no claims are withdrawn as non-elected.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

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2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 11-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adolf et al. (US 5,250,167) in view of Hirai et al. ((2003) Proc. of SPIE 5051: 198-206), Madden et al. (US 6,249,076), and Shahinpoor et al. (US 6,475,637). Adolf et al. teach a polymer actuator comprising: a plurality of gel/electrode complexes arranged in an electrolytic aqueous solution, said gel/electrode complex being composed of a polymer gel containing at least one of acidic and basic functional groups and electrodes placed in the polymer gel, said electrodes being made of a material capable of occluding and releasing hydrogen electrochemically, such that the polymer gel in the gel/electrode complex changes in pH upon application of voltage across the electrodes of the gel/electrode complexes and each of the gel/complexes changes in volume in response to the pH change (abstract, col. 1 lines 33-55). They teach that the complex may be arranged as a fiber (col. 3, lines 49-68) "as known in the art" and that the electrodes should project from the container (Fig. 4). They do not teach a palladium catalyst or a coil/mesh structure.

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Hirai et al. teach the creation of a polymer gel/electrode actuator using a range of gels; they discuss the relative merits and bending capability (which will translate to force available for the actuator) of the different gel types. They teach electrodes on both sides of the gel container (Fig. 10). They discuss the addition of “dopants” such as amine and carboxyl groups to the gel to control the redox nature of the polymer (section 3.3.3). Madden et al. teach An actuator comprising: an electrolyte; a counter electrode coupled to the electrolyte; and an active member comprising a polymer, the active member having an axis, a length defined along the axis, and having a surface coupled to the electrolyte, the active member capable of exerting, essentially along the axis, a force per unit area of at least 10 MPa concurrent with application of an electrical potential between the active member and the counter electrode (claim 1). They teach Palladium as one of the possibilities for an electrode (col. 6, lines 28-36). Shahinpoor et al. teach an actuating device comprising: an ion exchange polymer; a porous conductive layer embedded in said polymer with penetration inside said polymer comprising at least two embedded electrodes wherein application of an electrical potential across said electrodes causes movement of said polymer in a dry environment; and an impermeable flexible coating encapsulating said ion exchange polymer (claim 8), with the use of Palladium (col. 6, lines 25-40) and the use of a coil structure (col. 3, lines 19-26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Adolf et al., Hirai et al., Madden et al., and Shahinpoor et al., along with many other prior art teachings as enumerated in each of these, to create a polymer actuator using a gel/electrode complex. Various configurations of gel, electrodes, chemical reactions, and structures would be known in the art to provide the most motive force with the

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most stability of the system. As Hirai et al. state "the concept proposed is simple and can be applied to a wide range of materials"; they assert that sample durability for these actuators "was excellent" (conclusions). One would have a reasonable expectation of success in creating a gel/electrode actuator using the various systems as described by the prior art since many variations were already known and information on the construction, use, force available, reliability, and durability of the various configurations was publicly available.

### ***Response to Arguments***

Applicant's arguments filed 17 February 2009 have been fully considered but they are not persuasive. Applicants argue that that the prior art references teach the hydrolysis of water, not the system as disclosed by applicant using ionized cross-linked polyacrylamide gels, which avoid the release of gases. However, Shahinpoor teaches at col. 1, lines 26-28, that that "the creation of sensors and controllable actuators, or synthetic muscles, is known. Sensors and artificial muscles or actuators made from ion-exchange membranes are relatively new but known" and that the polymeric hydrogel components taught by applicants, see Example 1, are known "U.S. Pat. No. 5,100,933, to Tanaka, et al., discloses the use of ionized cross-linked polyacrylamide gels as engines or artificial muscles; the gels can contain a metal ion and are capable of discontinuous volume changes induced by infinitesimal changes in environment. The gel is made by dissolving acrylamide monomers and bisacrylamide monomers in water, adding a polymerization initiator (in particular, ammonium persulfate and TEMED, or tetramethylethylene-diamine) to the solution, soaking the gel sample in water to wash away all residual monomers and initiators, immersing the gel in a basic solution of TEMED for up to 60 days, then

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immersing the gel in a solvent (in particular, acetone, acetone in water, ethanol and water, or methanol and water). The primary disadvantages of these actuators are generally that the response time of the gel is much longer than that of other known actuator components and that the gel must be contained in the solvent bath. The gels are also mechanically brittle and easily broken" (col. 2, lines 3-20). Also, Madden et al. teach that the "electrolyte may be a liquid (which may require actuator encapsulation), a gel, or a solid"...specifically, the electrolyte may be a polymethylmethacrylate (PMMA) gel containing a salt dopant (col. 4, lines 15-20. As well, Hirai et al. teach that in addition to the PVA gel swollen with DMSO, they were able to achieve gel deformation and motive force using PVC and poly(methyl methacrylate) (p. 199).

Applicants argue that each of the references teaches away from the idea of the instant invention, however, each of the references, while disclosing multiple and various types and species of polymer actuators, discloses that polymer gel actuators are well known in the art, several teach that the use of cross-linked gel actuators comprising acrylamide components are known, several teach that electrodes of metal, such as palladium, are known, and several teach that electrodes in various configurations such as mesh and coil are known. Finally, each teaches that one of skill in the art knows how to place the electrodes to achieve optimal activity for the desired reaction of that, particular gel actuator.

Applicants argue that the elements of the references are combined by picking and choosing and that no reference teaches all the elements of the instant claims. However, the instant rejection is not that any one reference is anticipatory, it is that, taken as a whole, the prior art teaches that polymer actuators comprising gel/electrode complexes wherein acidic or basic functional groups and electrodes are placed within the gel, hydrogen is released during the

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application of voltage across the electrodes, and a volume change is generated creating deformation of the gel and motive force. Although applicants present explanatory language regarding their view of how the pH works in the instant electrode, it is not presented as a limitation; language in the claim which explains the action of a limitation, but is not itself a limitation, is given limited weight when interpreting the claims with the broadest reasonable interpretation. There is no negative limitation which recites that electrolysis or water or generation of hydrogen gas does not occur. Applicants admit that Adolf et al. teach the use of pH in relation to the gel complexes and the combination of a basic gel and an acidic gel in the complex. Also, they state that Adolf teaches the use of each electrode in connection with a specific pH level, while other references clearly teach that the electrodes may or may not be in direct contact with the gel solutions.

### ***Double Patenting***

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.



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Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 11-23 are provisionally rejected on the ground of nonstatutory double patenting over claims 14-26 of copending Application No. 10/536934. This is a provisional double patenting rejection since the conflicting claims have not yet been patented.

The subject matter claimed in the instant application is fully disclosed in the referenced copending application and would be covered by any patent granted on that copending application since the referenced copending application and the instant application are claiming common subject matter, as follows: a polymer actuator comprising a plurality of gel/electrode complexes arranged in an electrolytic solution gel/electrode complex being composed of a polymer gel containing acidic or basic functional groups and electrodes placed in the polymer gel, such that the polymer actuator changes in volume upon application of a voltage across said electrodes. Furthermore, there is no apparent reason why applicant would be prevented from presenting claims corresponding to those of the instant application in the other copending application. See *In re Schneller*, 397 F.2d 350, 158 USPQ 210 (CCPA 1968). See also MPEP § 804.

### *Art of Record*

The examiner notes the following prior art not relied upon in a rejection: Kurauchi et al. (JP40204168A). Kurauchi et al. teach a polymer gel electrode complex where voltage can be applied between the electrodes changing the volume of the gel, the solution is “swelled”, to create a mechanochemical actuator.

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***Conclusion***

No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lisa J. Hobbs whose telephone number is 571-272-3373. The examiner can normally be reached on Hotelling - Generally, 9-6 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jon P. Weber can be reached on 571-272-0925. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lisa J. Hobbs/  
Primary Examiner  
Art Unit 1657

ljh